8-7-21

1. i) $\vec{F} = q(\vec{v} \times \vec{B})$

$\vec{v} = v\hat{i}$, $\vec{B} = B\hat{j}$

$\Rightarrow \vec{F} = q((v\hat{i}) \times (B\hat{j})) = qvB\hat{k}$

$eE = evB$

$\Rightarrow v = \frac{E}{B}$

$\Rightarrow v = \frac{50 \times 10^3}{100 \times 10^{-3}} = 5 \times 10^5 \text{ m s}^{-1}$

ii) The beam strikes the target with a const. velocity, so force exerted ~~is~~ on target is zero. However, if proton beam comes to rest it exerts a force on the target, equal to rate of change of linear momentum of the beam. i.e.

$F = \frac{\Delta p}{\Delta t} = \frac{mv}{\Delta t} = \frac{mv}{q/i} = \frac{mvi}{q} = \frac{mvi}{ne}$

n → no. of protons striking per second

2. The magnetic field must be along z-axis.

3. When a charge of 1 C, moving with velocity 1 m/s normal to the magnetic field, ~~it~~ experiences a force 1 N, the magnetic field is said to be one tesla.

4. Mass of electron is low as compared to proton. Hence when both enter into uniform magnetic region, the electron will move in a circular path and with a higher frequency in the ~~on~~ on the opposite direction to the current.

5. When an electron enters normal to field direction the trajectory is circular.
When it enters at 30° to field it forms helical trajectory.